THE TOLERANCE TO 1080 OF THE RUFOUS HARE-WALLABY *LAGORCHESTES HIRSUTUS*

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The Rufous Hare-Wallaby, *Lagorchestes hirsutus*, was formerly widespread throughout the spinifex deserts of central Australia (Lundie-Jenkins 1993). Wild populations are now known to occur only on Bernier and Dorre Islands in Western Australia (Gibson *et al.* 1994) and occupy less than 1% of the former range of the species (Johnson *et al.* 1989). A captive breeding program was established in Alice Springs in 1980 to enable reintroductions to occur (Gibson *et al.* 1994). The breeding stock consisted of Hare-Wallabies from the last known mainland population in the Tanami Desert (Gibson *et al.* 1994). Survival of wild populations (Lundie-Jenkins *et al.* 1993) and reintroductions (Gibson *et al.* 1994) of Hare-Wallabies have been seriously hampered by predation by Foxes (*Vulpes vulpes*) and feral Cats (*Felis catus*). Reintroductions of other Australian species of mammals to mainland sites have generally had poor records of success (Short and Smith 1994).

The most successful reintroduction programs have involved control of exotic predators by using 1080 baits (Short and Smith 1994). Many native Australian species have evolved high tolerances to 1080, which occurs naturally in the plant genera *Gastrolobium* and *Acacia* (Twigg and King 1991). Introduced predators such as Cats (Eason and Frampton 1991) and Foxes (McIlroy and King 1990) are very susceptible to the poison.

Testing was conducted on four male Hare-Wallabies from the captive breeding program in Alice Springs, founded from the now extinct Tanami desert population. The animals were supplied by the Conservation Commission of the Northern Territory. They were individually housed in wooden and steel mesh cages (1200 by 900 by 580 mm), with straw bedding, in an air conditioned animal house (23±1°C). They were fed lucerne and kangaroo cubes. Food and water was supplied ad lib.

Animals were dosed intraperitoneally with increasingly large doses of 1080 in aqueous solution, with an interval of 38–88 days between doses (Table 1). Blood samples were collected from a lateral caudal vein before dosing and at 6, 12 and 24 hours after dosing to determine alterations in plasma citrate

Table 1. Dose rates of 1080 and survival of Rufous Hare-Wallabies, *Lagorchestes hirsutus*.

Dose (mg kg^{-1})	No. dosed	Died	Bled
2	4	0	yes
3	4	0	yes
5	4	0	yes
7.5	4	0	yes
10	2	0	no
15	4	0	yes
20	2	0	no
25	1	1	no

levels, which can be used to determine tolerance to 1080 in closely related species (Twigg and King 1991).

Animals were not bled at all dose levels (Table 1), as the stress of handling them can increase the response of animals to toxins and at high levels, can increase the likelihood of their death (Ellis 1967).

All Hare-Wallabies survived doses of 2–20 mg kg^{-1} (Table 1). The only *L. hirsutus* given 25 mg kg^{-1} died between 32 and 48 hours after it was dosed. Symptoms of 1080 poisoning were first observed 24 hours after dosing. Of the two animals dosed at 10 mg kg^{-1}, one showed mild symptoms of 1080 poisoning, as did all animals dosed with 15 and 20 mg kg^{-1}.

Baseline (pre-dose) plasma citrate levels ranged from 25.0 to 34.7 µg ml^{-1}, and the elevation of citrate levels increased as the Hare-Wallabies received higher doses of 1080 (Table 2). There are no data on citrate levels for Hare-Wallabies dosed at 20mg kg^{-1} or for the animal which died after receiving a dose of 25 mg kg^{-1}. The maximum elevation found in animals dosed at 15 mg kg^{-1} (60% of the lethal dose) was 113 µg ml^{-1}. One male Hare-Wallaby of a different species, the Spectacled Hare-Wallaby (*L. conspicillatus*) survived a dose of 3 mg kg^{-1}, after which its plasma citrate level increased by over 160 µg ml^{-1}, and died after receiving 5 mg kg^{-1} between 24 and 48 hours later. Its citrate level 24 hours after being dosed with 5 mg kg^{-1} had increased by approximately 260 µg ml^{-1} (Twigg 1982).

The tolerance to 1080 of the Rufous Hare-Wallaby is lower than that of some macropods from Western Australia which coexist with fluoroacetate-bearing vegetation, but is higher than that of other species,

Table 2. Mean changes in plasma citrate levels of Rufous Hare-Wallabies (*Lagorchestes hirsutus*) after being dosed with 1080.

Dose (mg kg^{-1})	No. dosed	Baseline (pre-dose)	Increase in citrate level (µg ml^{-1}) 6 hours	12 hours	24 hours
2	4	29.4	15.5	24.9	15.5
3	4	34.7	47.8	34.1	-0.2
5	4	32.9	42.7	30.3	14.8
7.5	4	30.4	59.7	52.7	17.1
15	4	25.0	72.3	64.8	70.3

including the Spectacled Hare-Wallaby, which also occur in arid areas where *Gastrolobium* species are not abundant or do not occur (Twigg 1986; Twigg and King 1991). The relatively high tolerance of the Rufous Hare-Wallaby to 1080 could have been acquired as a result of their ancestral stock feeding on one or more *Gastrolobium* species which occur over much of the former range of the species which includes much of the Western Australian wheatbelt where many species of *Gastrolobium* occur, or from the Tanami Desert population feeding on *G. grandiflorum* which is found over a large part of central Australia, including the Tanami Desert (Twigg and King 1991). Bilbies (*Macrotis lagotis*) from the Tanami Desert also have a relatively high tolerance to 1080 (Twigg *et al.* 1990).

Baits used in Fox and Cat control programs generally consist of meat injected with a small amount (2.5–4.5 mg) of 1080. The Rufous Hare-Wallaby is herbivorous (Lundie-Jenkins *et al.* 1993) and is unlikely to eat meat baits designed for either Foxes or Cats. There is a demonstrated need for exotic predator control in areas of Australia where the Rufous Hare-Wallaby (Gibson *et al.* 1994) or other species of mammals (Short and Smith 1994) are reintroduced. The high sensitivity to 1080 of Foxes (McIlroy and King 1990) and Cats (Eason and Frampton 1991) relative to the relatively high tolerance of the Rufous Hare-Wallaby enabled 1080 to be used in a highly selective way in predator control programs. Single baits which would be lethal to the predators can be manufactured. Even if they were eaten by Hare-Wallabies, no threat of lethal poisoning would be posed to them, as the amount of 1080 ingested would be well below a lethal dose for a Hare-Wallaby. Similar successful management programs using 1080 baits to control introduced carnivores and benefit native fauna (Kinnear *et al.* 1988; Friend 1990) have recently been conducted by the Department of Conservation and Land Management in Western Australia.

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REFERENCES

EASON, C. T. and FRAMPTON, C. M. 1991. Acute toxicity of sodium monofluoroacetate (1080) baits to feral Cats. *Wildl. Res.* 18: 445–449.

ELLIS, T. M. 1967. Environmental influences on drug responses in laboratory animals. *In: Husbandry of Laboratory Animals.* (Ed. M. L. Conalty). Academic Press: London.

FRIEND, J. A. 1990. The numbat (Myremecobiidae): history of decline and potential for recovery. *Proceedings of the Ecological Society of Australia* 16: 369–377.

GIBSON, D. F., LUNDIE-JENKINS, G., LANGFORD, D. G., COLE, J. R., CLARKE, J. E. and JOHNSON, K. A. 1994. Predation by feral Cats, *Felis catus*, on the Rufous Hare-Wallaby, *Lagorchestes hirsutus*, in the Tanami Desert. *Aust. Mammal.* 17: 103–107.

JOHNSON, K. A., BURBIDGE, A. A. and MCKENZIE, N. L. 1989. Australian macropodoidea: Status, causes of decline and future research and management. *In: Kangaroos, Wallabies and Rat-kangaroos.* (Eds G. Grigg, I. D. Hume and P. J. Jarman) pp. 641–657. Surrey Beatty and Sons: Sydney.

KINNEAR, J. E, ONUS, M. L and BROMILOW, R. N. 1988. Fox control and Rock-Wallaby population dynamics. *Aust. Wildl. Res.* 15: 435–450.

LUNDIE-JENKINS, G. 1993. Ecology of the Rufous Hare-Wallaby, *Lagorchestes hirsutus* Gould (Marsupialia: Macropodidae), in the Tanami desert, Northern Territory. I. Patterns of habitat use. *Wildl. Res.* 20: 457–476.

LUNDIE-JENKINS, G., CORBETT, L. K. and PHILLIPS, C. M. 1993. Ecology of the Rufous Hare-Wallaby, *Lagorchestes hirsutus* Gould (Marsupialia: Macropodidae), in the Tanami desert, Northern Territory. III. Interactions with introduced mammal species. *Wildl. Res.* 20: 495–511.

MCILROY, J. C. and KING, D. R. 1990. Appropriate amounts of 1080 poison in baits to control Foxes, *Vulpes vulpes*. *Aust. Wildl. Res.* 17: 11–13.

SHORT, J. and SMITH, A. 1994. Mammal decline and recovery in Australia. *J. Mammal.* 75: 288–297.

TWIGG, L. E. 1982. The co-evolutionary role of fluoroacetate: assessment of tolerance to fluoroacetate of Australian native fauna. B. Sc. (Hons.) thesis, Murdoch University, Perth.

TWIGG, L. E. and KING, D. R. 1991. The impact of fluoroacetate-bearing vegetation on native Australian fauna: a review. *Oikos* 61: 412–430.

TWIGG, L. E., KING, D. R. and MEAD, R. J. 1990. Tolerance to fluoroacetate of populations of *Isoodon* spp. and *Macrotis lagotis* and its implications for fauna management. pp 185–192 *In: Bandicoots and Bilbies* ed by J. H. Seebeck, P. R. Brown, R. L. Wallis and C. M. Kemper. Surrey Beatty and Sons, Sydney.